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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,415	04/08/2004	Mirmajid Seyyedy	MICRON.169DV1	7823

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EXAMINER	
HO, TU TU V	

ART UNIT	PAPER NUMBER
2818	

DATE MAILED: 09/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/820,415	SEYYEDY ET AL.	
	Examiner	Art Unit	
	Tu-Tu Ho	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *07/12/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Oath/Declaration

1. The oath/declaration filed on 04/08/2004 is acceptable.

Election/ Restriction

2. Applicant's election without traverse of Group I, claims 1-7, and cancellation of claims 8-16 in Paper filed 09/09/2004 are acknowledged.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. **Claims 1-2 and 4** are rejected under 35 U.S.C. 102(e) as being anticipated by Tran et al. U.S. Patent 6,473,337 (cited in the parent application and hereinafter U.S. Patent 6,473,337 will be referred to as the '337 patent).

The '337 patent discloses in Figures 2, 3C, and 4 and respective portions of the specification an antifuse device for an integrated circuit as claimed.

Referring to **claim 1**, the '337 patent discloses an antifuse device (134, Fig. 3C and column 8, lines 40-43) for an integrated circuit (Fig. 2) formed on a substrate (128/132, Fig. 3C), the antifuse device comprising:

a first layer (137, Fig. 3C) of magnetic material formed on an exposed surface of the substrate (note that "on an exposed surface of the substrate" is interpreted broadly as will be explained in more details below in reference to dependent claim 6);

a second layer (138) of magnetic material positioned above the first layer;

a dielectric layer (140) interposed between the first layer and the second layer wherein the first layer, the second layer and the dielectric layer form an MTJ junction ("magnetic tunnel junction", column 8, lines 40-43); and

a logic circuit that is selectable so as to interconnect the first layer to a first electrical potential such that the first and second layers of magnetic material are shorted together when the logic circuit is selected (column 8, EXAMPLE 1).

Referring to **claim 2**, the '337 patent further discloses that the first layer (137) comprises a pinned layer of magnetic material that is magnetized in a first fixed direction, the second layer (138) comprises a soft layer of material that can be magnetized in either the first fixed direction or a second direction, and the dielectric layer comprises a tunnel dielectric layer (140) interposed between the first layer and the second layer (column 5, lines 50-67).

Referring to **claim 4**, the '337 patent further discloses that the antifuse device has a resistance of greater than approximately 1 MegaOhm prior to the interconnection to the first electrical potential and wherein the antifuse device, upon interconnection to the first electrical potential is shorted across the tunnel dielectric layer (Fig. 4 and column 8, EXAMPLE 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. **Claims 3 and 5** are rejected under 35 U.S.C. §103(a) as being unpatentable over the '337 patent for being obvious.

Referring to **claim 3**, the '337 patent discloses an MTJ antifuse device for an integrated circuit as claimed and as detailed above and further discloses that the first layer (137) comprises NiFe of about 40 angstroms thick, the second layer (138) comprises a layer of NiFe that is approximately 40 angstroms thick, and the dielectric layer comprises a layer of AlO that is approximately 25 angstroms thick. Although the prior art's thickness of 40 angstroms for the first layer is not the same as 100-500 angstroms as claimed and the prior art's thickness of 25 angstroms for the tunneling dielectric layer is not the same as 10-15 angstroms as claimed, the differences in thickness do not result in changes in properties, i.e., as ferromagnetic layer and tunneling dielectric layer respectively for the *magnetic tunnel* junction MTJ antifuse, therefore the changes would have been obvious to one of ordinary skill in the art at the time the invention was made. See also, for example, Scheler et al. U.S. Patent 6,630,703, last paragraph of column 6 and first paragraph of column 7, in teaching MTJ ("TMR", tunneling magnetoresistive) and GMR (giant magnetoresistive) elements, disclosing that the first ferromagnetic layer and the second ferromagnetic layer of an MTJ element each has a thickness of between 2 nm and 20 nm

and that the dielectric (non-magnetic insulating) layer is about between 1 nm – 4 nm for MTJ effects, thereby disclosing ranges of thickness that overlap or encompass the prior art's and the claimed.

Referring to **claim 5**, the '337 patent discloses an MTJ antifuse device for an integrated circuit as claimed and as detailed above and further discloses that the selected voltage is about 1.9 volts (column 8, lines 25-30). Although the prior art's breakdown voltage of 1.9 volts is not the same as 1.8 volts as claimed, the differences in electrical potential does not result in changes in properties or results, i.e., breaking down the dielectric layer and shorting out the first magnetic layer and the second magnetic layer of the magnetic tunnel junction antifuse, therefore the changes would have been obvious to one of ordinary skill in the art at the time the invention was made.

5. **Claims 6-7** are rejected under 35 U.S.C. §103(a) as being unpatentable over the '337 patent for being obvious or in view of Scheler et al. U.S. Patent 6,630,703 (the '703 patent).

The '337 patent discloses an MTJ antifuse device for an integrated circuit as claimed and as detailed above and further discloses a pinning layer comprising IrMn that is approximately 100 angstrom thick ("anti-ferromagnetic layer" 144 of IrMn and about 10nm thick, Fig. 3C, and column 8, lines 16-18), but fails to disclose a first barrier layer and a second barrier layer, and thus fail to disclose that the first barrier layer and the second barrier layer each comprises a layer of Ta. However, the use of Ta as a *barrier*/adhesive layer, for the purpose of providing contamination barrier during processing and adhesive properties between element layers, in the semiconductor art in general and, in particular, in the art of forming MTJ elements, is known.

See, for example, the '703 patent, column 9, last paragraph and Fig. 5, which discloses a first Ta barrier layer 47 and a second Ta barrier 49 sandwiching MTJ element 48, for the purpose of providing barrier and adhesive properties in relations to other layers. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the MTJ antifuse as disclosed by the '337 patent including a first barrier layer and a second barrier layer. One would have been motivated to make such a modification in view of the suggestion in the '703 patent or as is known in the art that Ta barrier layers providing barrier properties during processing and adhesive properties between element layers.

Referring to **claim 7**, the second barrier layer of the prior art is about 200 angstroms thick as claimed (the '703 patent, column 9, lines 50-52, 10 to 30nm). As for the first barrier layer, although the prior art's thickness of 100-300 angstroms is not the same as 50 angstroms as claimed, the difference in thickness does not result in changes in properties, i.e., as barrier layer for the MTJ element for an integrated circuit, therefore the change would have been obvious to one of ordinary skill in the art at the time the invention was made.

Also, as noted above, "on an exposed surface of the substrate" in "a first layer of magnetic material formed on an exposed surface of the substrate" of claim 1 is interpreted broadly. To be specifically, "on an exposed surface of the substrate" is not interpreted as "in contact with an exposed surface of the substrate". The limitations of claim 6, which depends on claim 1, further clarify this view.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tu-Tu Ho whose telephone number is (571) 272-1778. The examiner can normally be reached on 6:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DAVID NELMS can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TH

Tu-Tu Ho
September 23, 2004